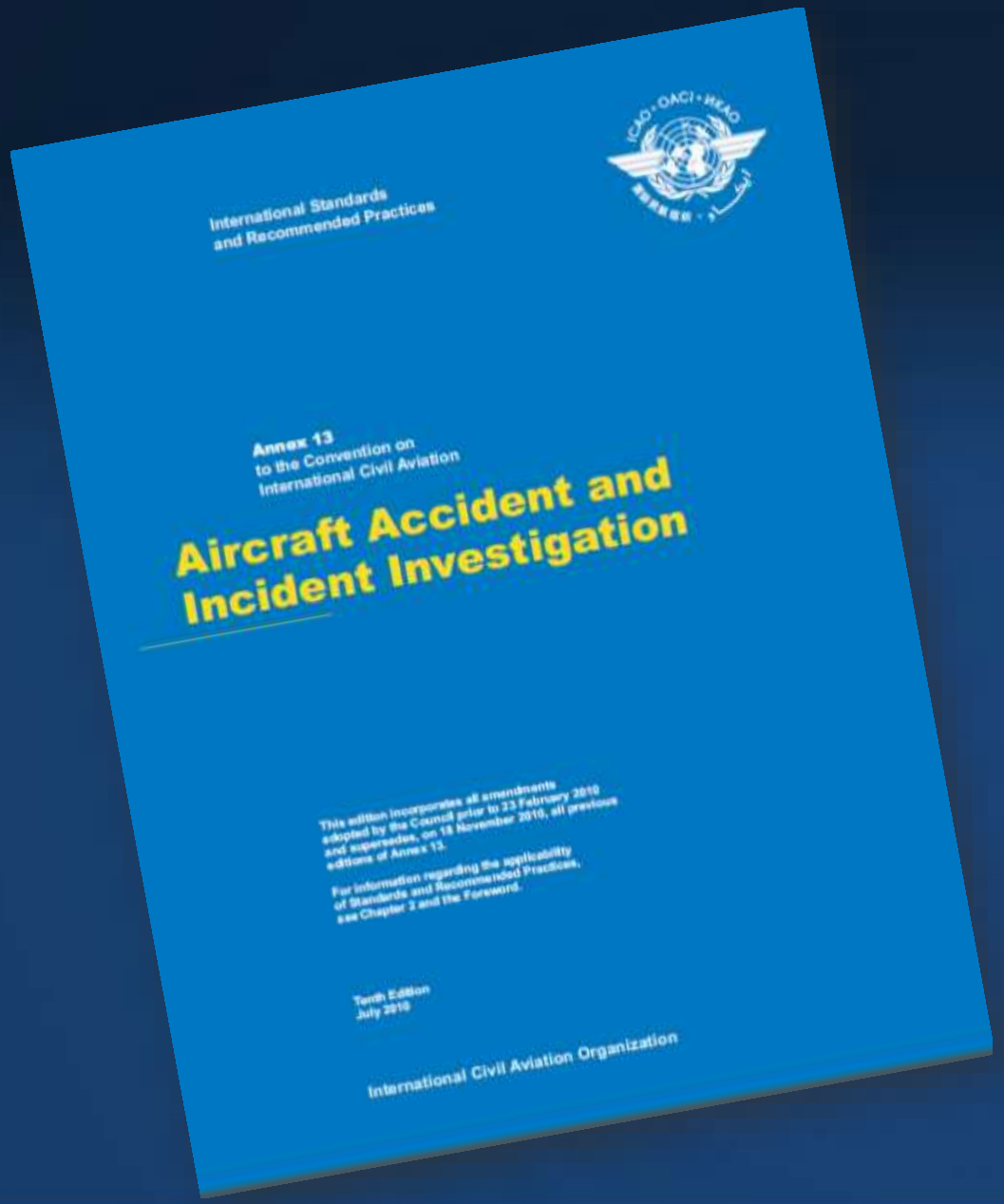
Lessons from the Ashes: Improving International Aviation Safety through Accident Investigation

14th Annual Assad Kotaite Lecture
Royal Aeronautical Society
Robert Sumwalt FRAeS
December 7, 2017

7

International Civil Aviation Day

"Working Together to Ensure No Country is Left Behind."



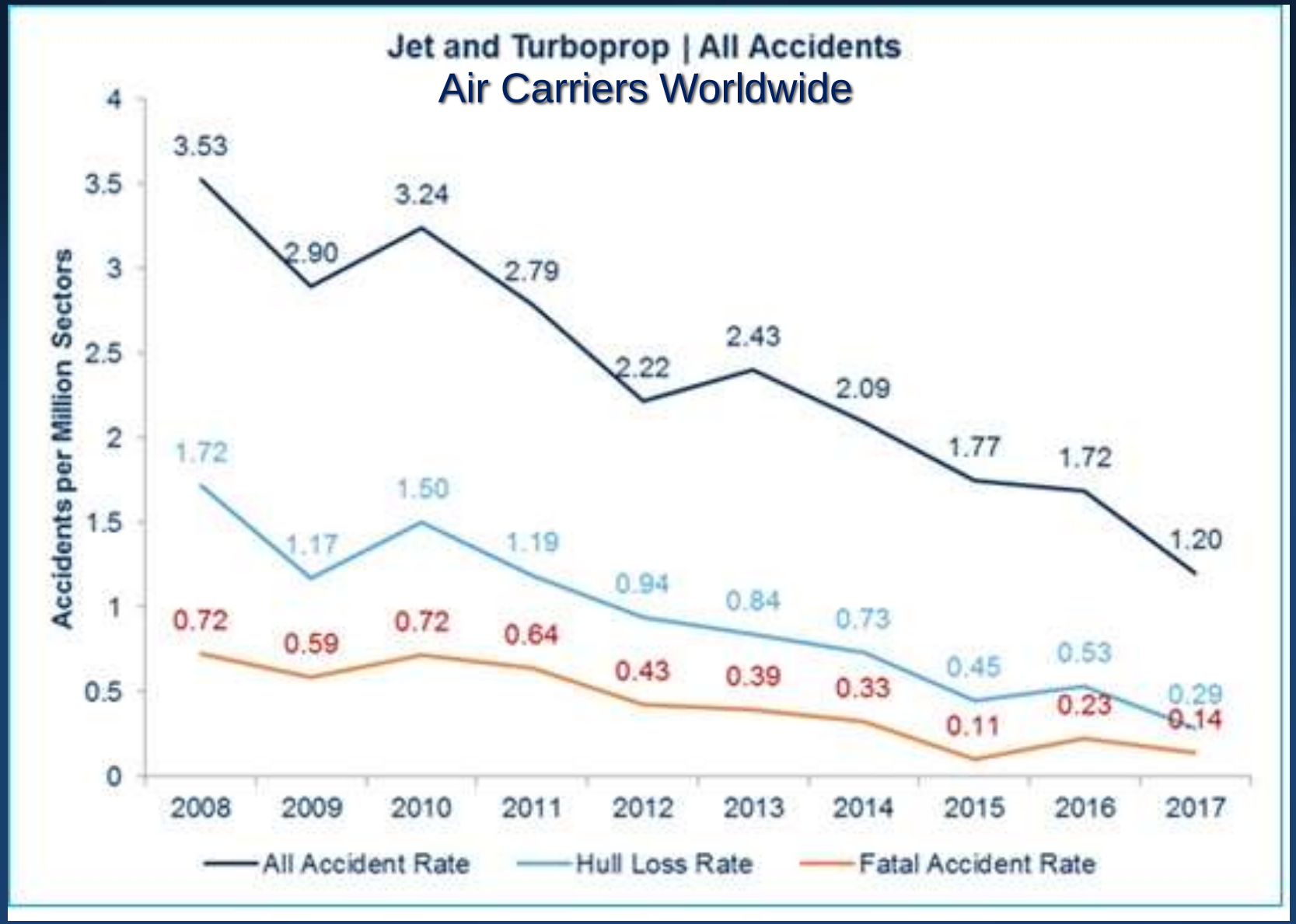
"The sole objective of the investigation of an accident or an incident shall be the prevention of accidents and incidents. It is not the purpose of this activity to apportion blame or liability."

- Annex 13, paragraph 3.1

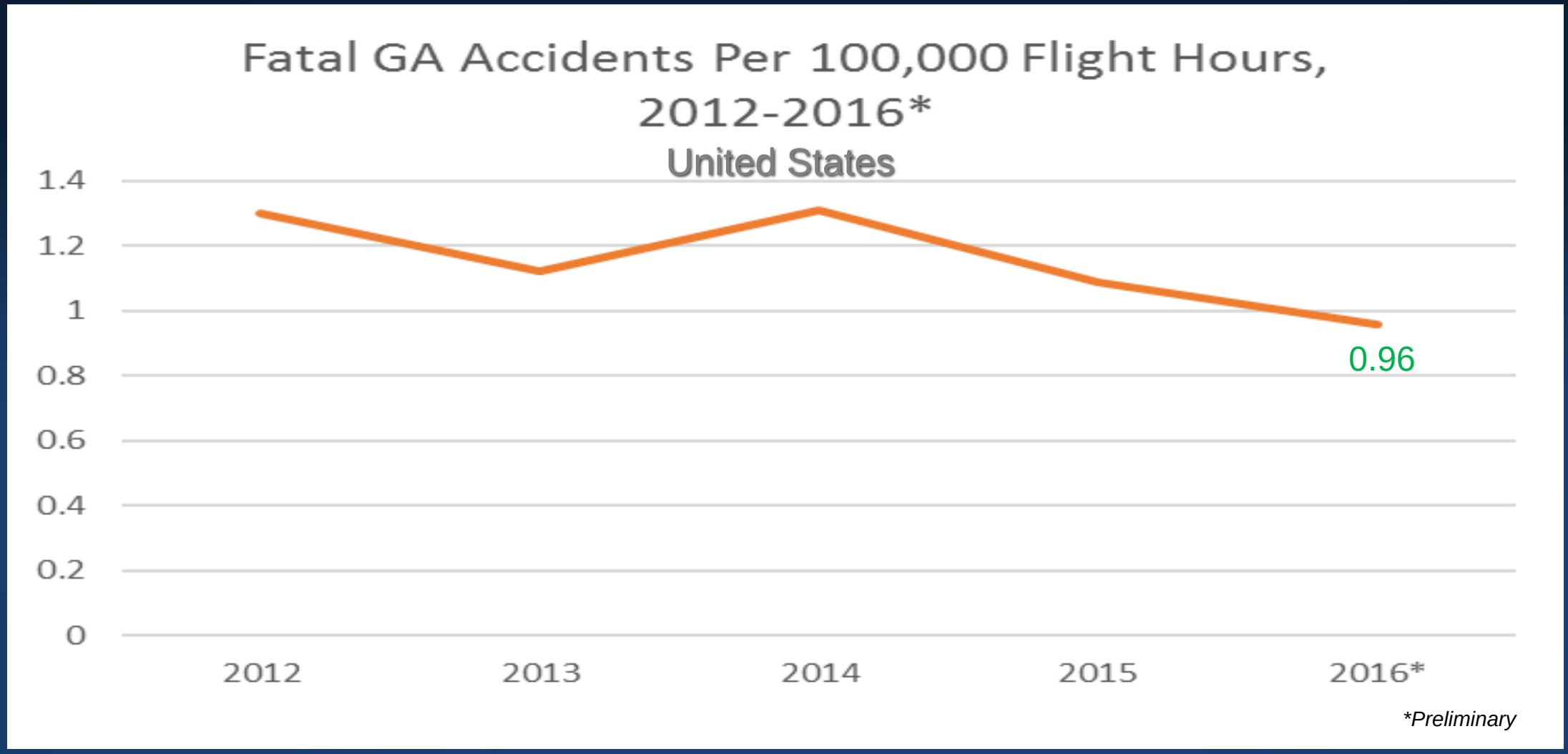
Monday's Headlines
January 12, 2009

Friday's Headlines
January 16, 2009

4 Weeks Later
February 12, 2009


Jet and Turboprop | All Accidents
Air Carriers Worldwide
Accidents per Million Sectors
4
3.5
3
2.5
2
1.5
1
0.5
0
3.53
2.90
3.24
2.79
2.22
2.43
2.09
1.77
1.72
1.20
1.72
1.17
1.50
1.19
0.94
0.84
0.73
0.45
0.53
0.29
0.72
0.59
0.72
0.64
0.43
0.39
0.33
0.11
0.23
0.14
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
All Accident Rate
Hull Loss Rate
Fatal Accident Rate

Source: IATA


Fatal GA Accidents Per 100,000 Flight Hours, 2012-2016*
United States
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0.96
2012
2013
2014
2015
2016*
*Preliminary


DEADLY
BALLOON CRASH
NEWS

Things that keep Robert up at night

- Drones ?
- CFIT ?
- Loss of Control ?
- Runway Safety
- Automation Dependency/Reliance ?

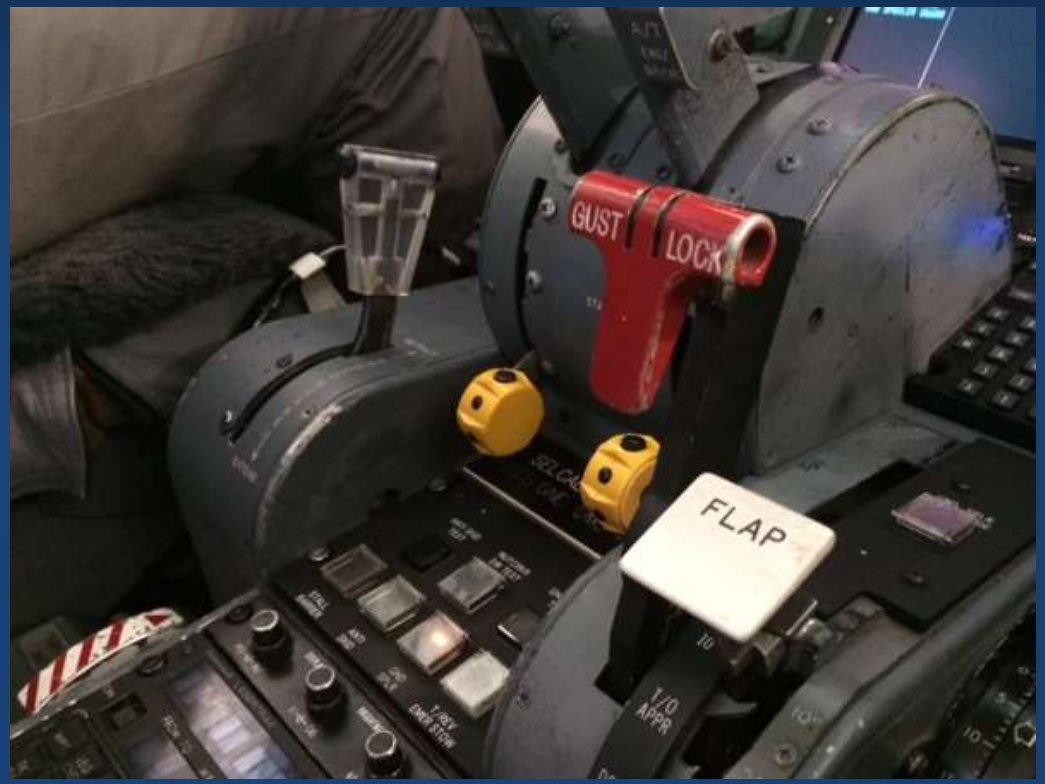
COMPLACENCY

Bedford, Massachusetts


NTSB

NTSB Investigation Found

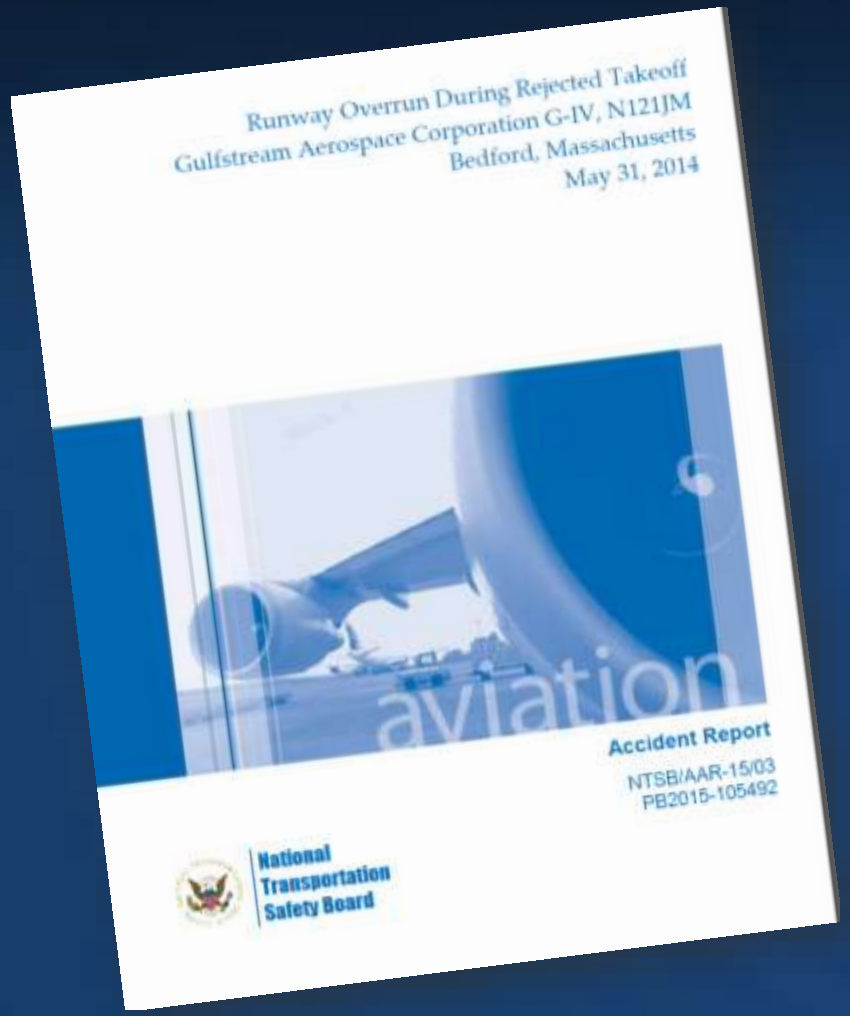
- The flight crew failed to disengage the gust lock.
- None of the five manufacturer specified-checklists were verbalized on the accident flight.
- No complete flight control check for 173 of the past 175 flights.



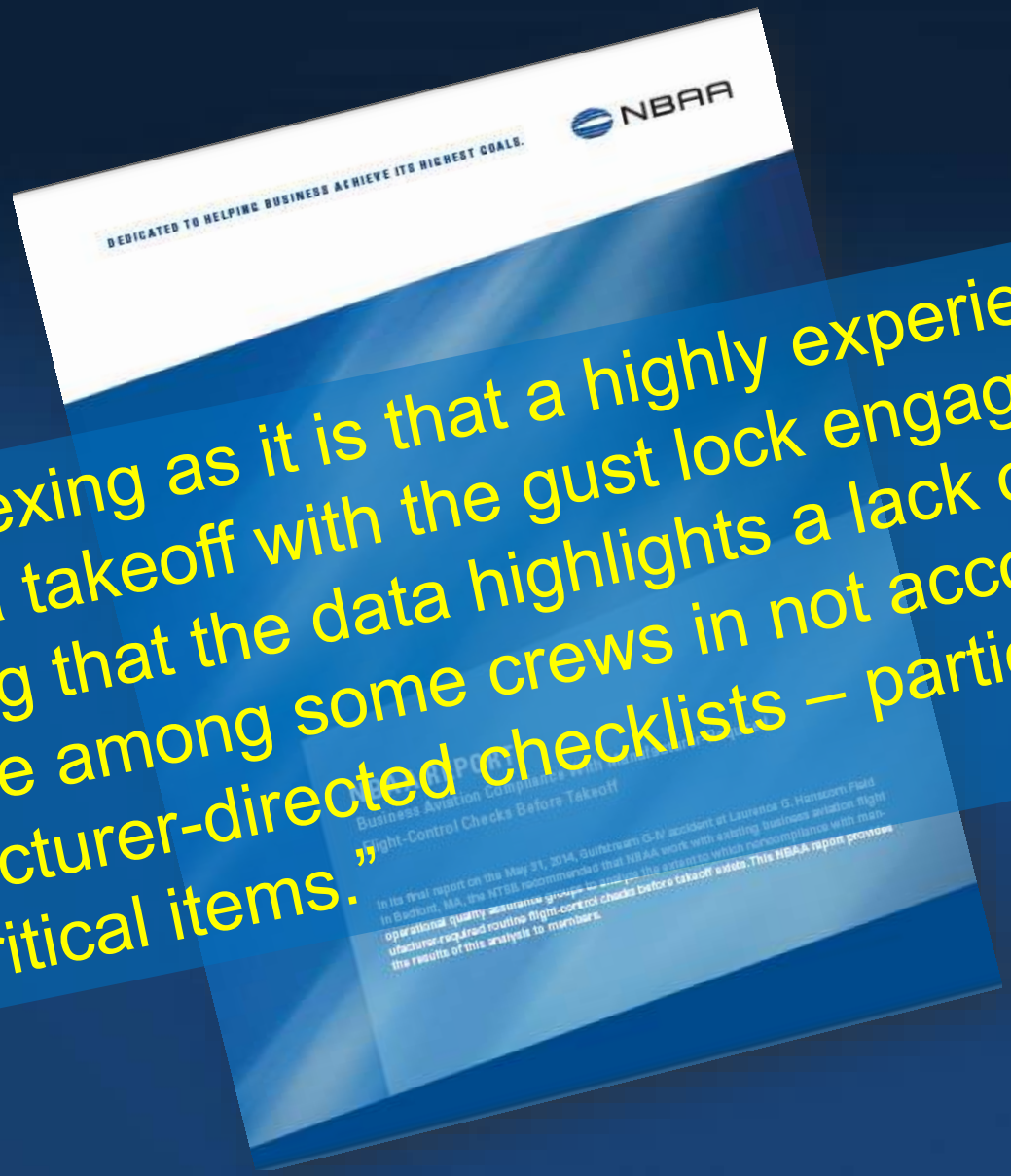
Probable Cause

- The NTSB determines that the probable cause of this accident was the flight crewmembers' failure to perform the flight control check before takeoff…
- Contributing to the accident were the flight crew's habitual noncompliance with checklists …

Safety Recommendations



- FAA (3)
- International Business Aviation Council (IBAC) (1)
- National Business Aviation Association (NBAA) (1)



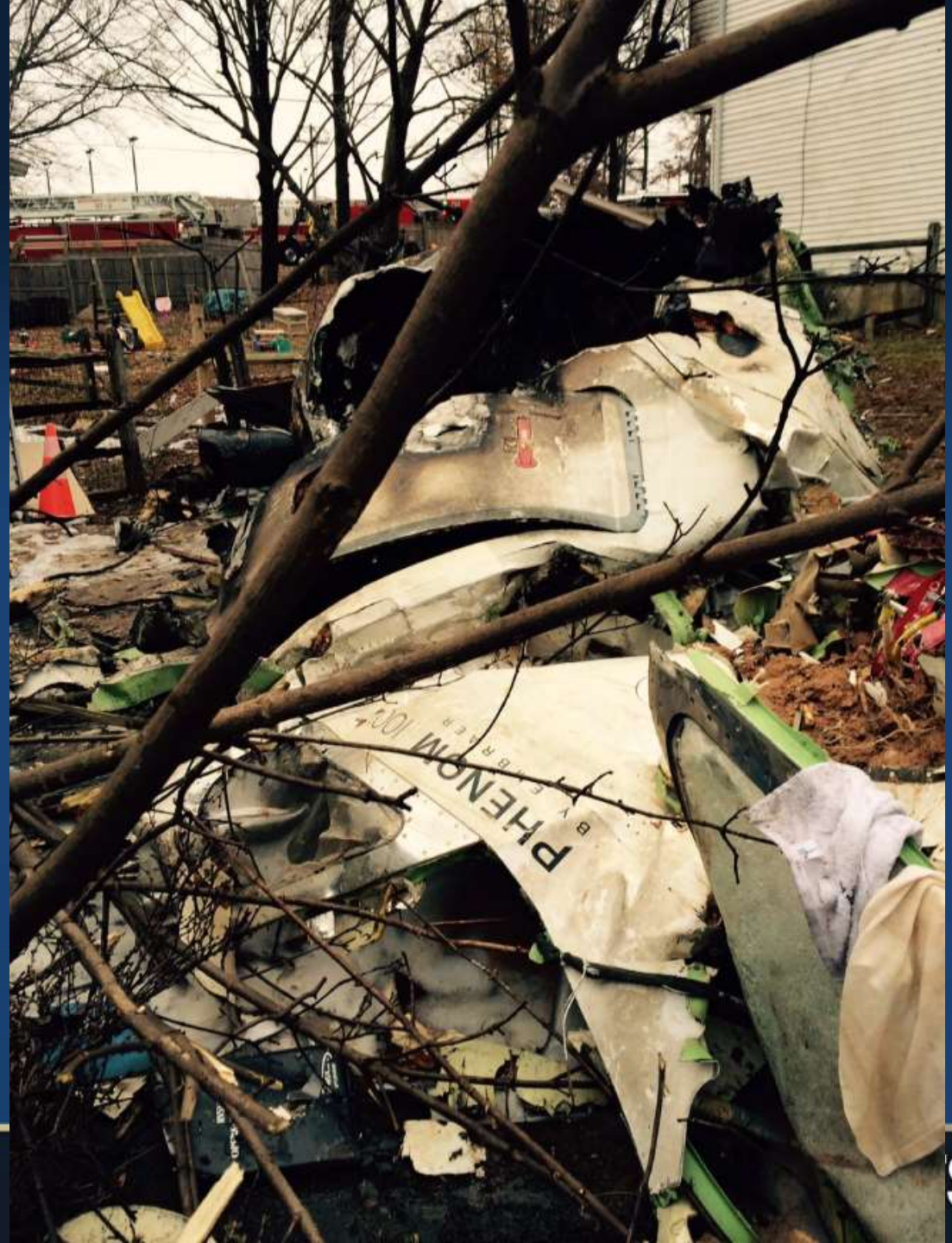
"As perplexing as it is that a highly experienced crew could attempt a takeoff with the gust lock engaged, it is equally disturbing that the data highlights a lack of professional discipline among some crews in not accomplishing manufacturer-directed checklists – particularly safety-of-flight critical items."

"… complacency and lack of procedural discipline have no place in our profession."

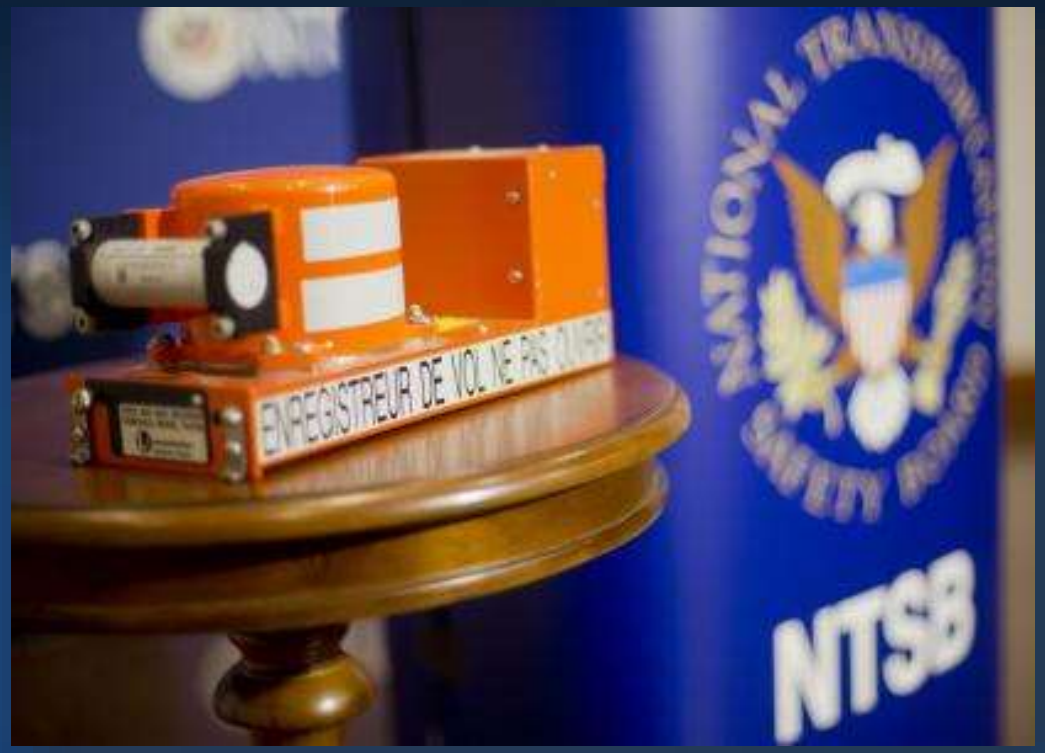
Gaithersburg, Maryland

December 2014

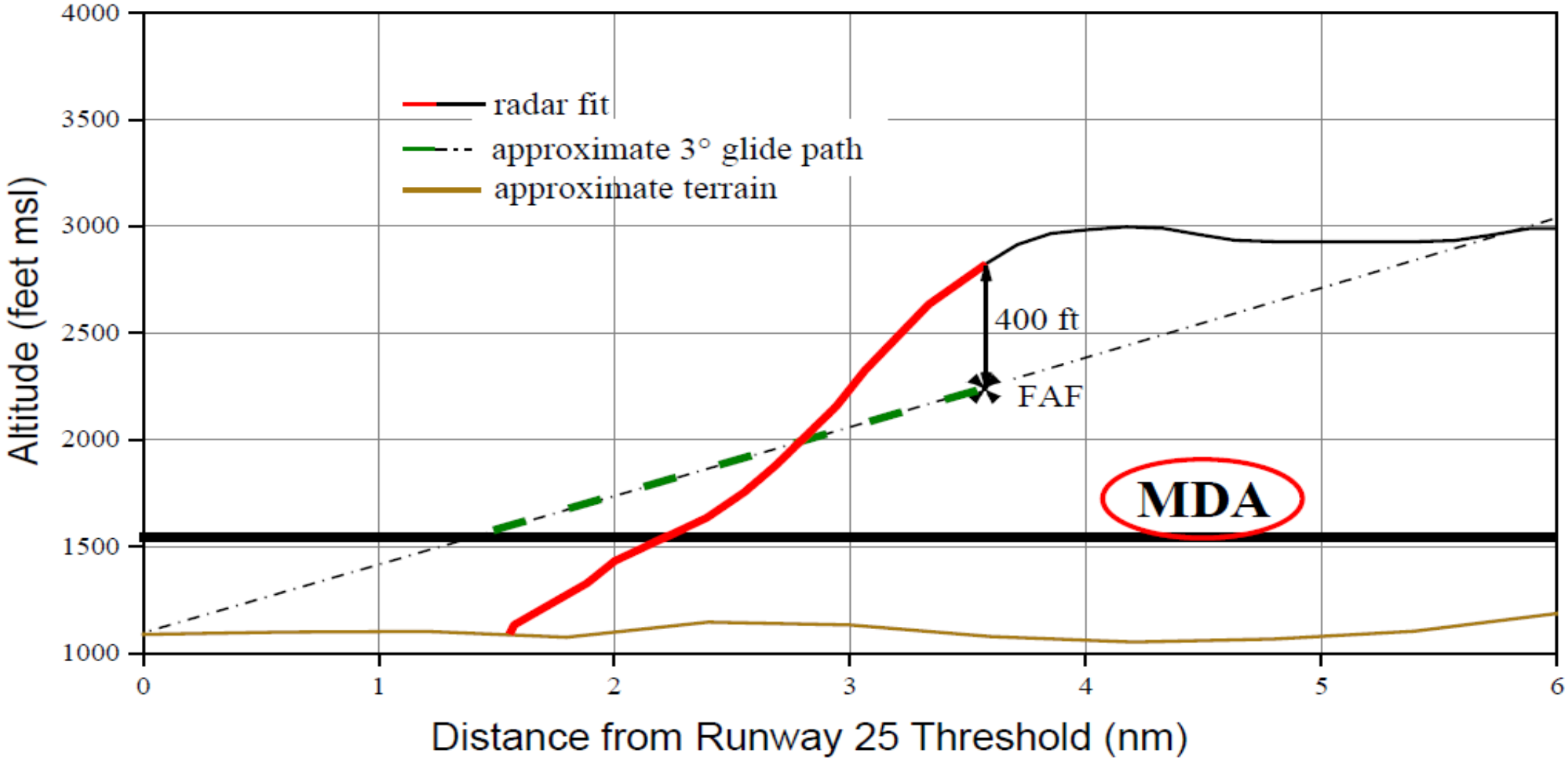

NTSB



“Embraer’s decision to install a cockpit voice and data recorder in the EMB-500 fleet greatly benefited the NTSB’s investigation …
by ensuring investigators had access to critical information for determining the sequence of events that led to the accident and identifying actions needed to prevent a similar accident in the future.”




Akron, Ohio
November 2015


4000
3500
3000
2500
2000
1500
1000
Altitude (feet msl)
radar fit
approximate 3° glide path
approximate terrain
400 ft
FAF
MDA
0
1
2
3
4
5
6
Distance from Runway 25 Threshold (nm)


Runway
25
Threshold
Accident
Site

Aerial View of Destroyed Building

Probable Cause

- The flight crew's mismanagement of the approach and multiple deviations from company standard operating procedures, which placed the airplane in an unsafe situation and led to an unstabilized approach, a descent below minimum descent altitude without visual contact with the runway environment, and an aerodynamic stall.
- Contributing to the accident were Execuflight's casual attitude toward compliance with standards; its inadequate hiring, training, and operational oversight of the flight crew; the company's lack of a formal safety program; and the Federal Aviation Administration's insufficient oversight of the company's training program and flight operations.

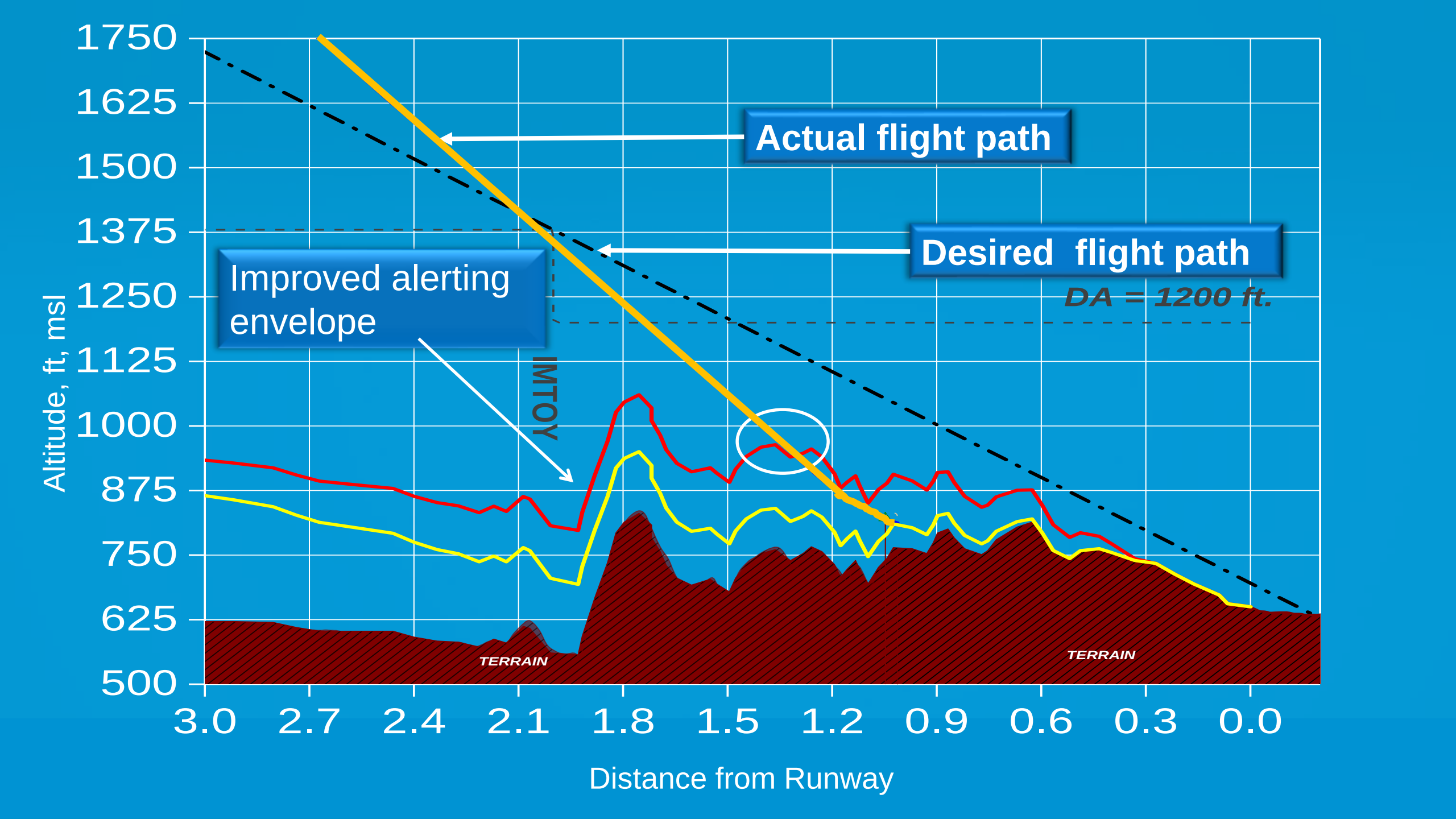
14 Safety Recommendations

- FAA (10)
- Textron (2)
- Hawker training centers (2)

Birmingham, Alabama
August 2013


runway 18 threshold
aft fuselage
engines and forward fuselage
rising terrain
ground contact
first tree strike

Terrain Warning and Alerting System (TAWS)


1750
1625
1500
1375
1250
1125
1000
875
750
625
500
Altitude, ft, msl
3.0
2.7
2.4
2.1
1.8
1.5
1.2
0.9
0.6
0.3
0.0
Distance from Runway
Actual flight path
Desired flight path
DA = 1200 ft.
Improved alerting envelope
IMTOY
TERRAIN
TERRAIN

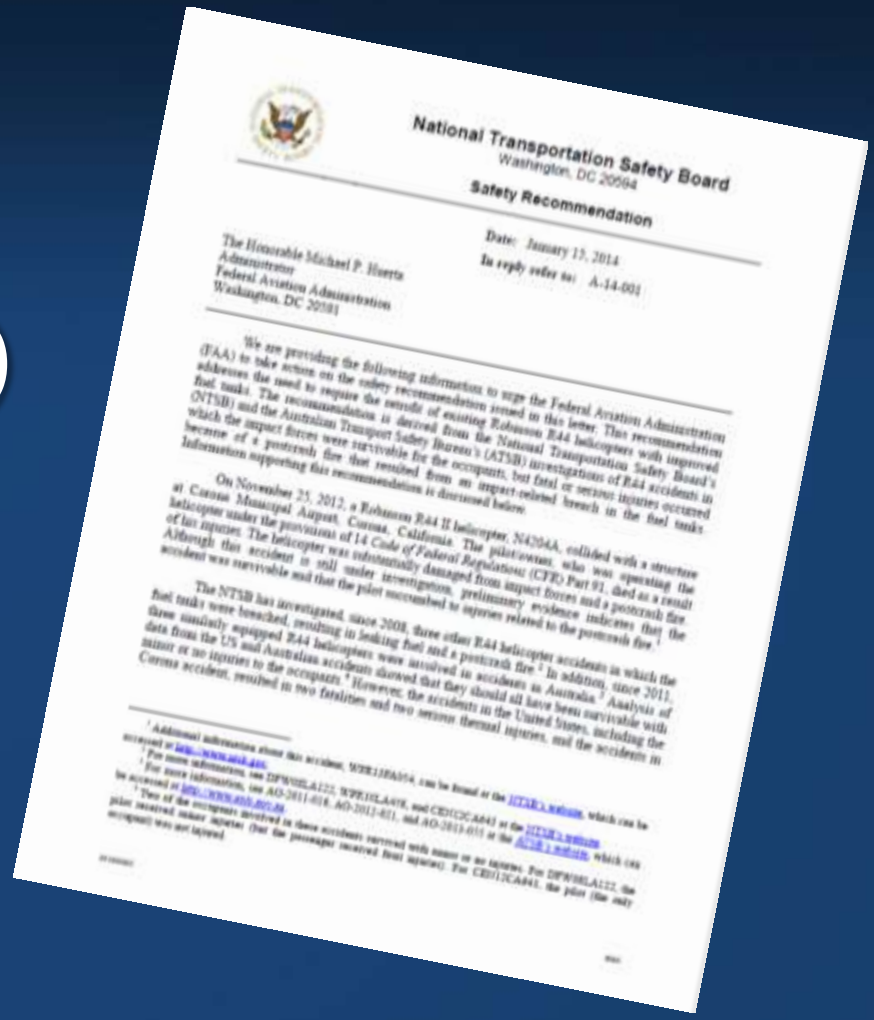
NTSB Findings: TAWS

- Newer TAWS software would have provided a “too low terrain” caution alert 6.5 seconds sooner and 150 feet higher.
  - Because of the excessive descent rate and not knowing how aggressively the pilots would have responded, the effect on the accident could not be determined.

- An escalating series of TAWS alerts before impact with terrain or obstacles is not always guaranteed due to technological limitations, which reduces the safety effectiveness of the TAWS during the approach to landing.

20 Recommendations

- FAA (15)
- Independent Pilots Assn. (2)
- UPS (2)
- Airbus (1)



National Transportation Safety Board
Washington, DC 20594

Safety Recommendation

Date: January 13, 2014
In reply refer to: A-14-001

The Honorable Michael P. Huerta
Administrator
Federal Aviation Administration
Washington, DC 20591

We are providing the following information to urge the Federal Aviation Administration (FAA) to take action on the safety recommendation issued in this letter. This recommendation addresses the need to require the retrofit of existing Robinson R44 helicopters with improved fuel tanks. The recommendation is derived from the National Transportation Safety Board's (NTSB) and the Australian Transport Safety Bureau's (ATSB) investigations of R44 accidents in which the impact forces were survivable for the occupants, but fatal or serious injuries occurred because of a postcrash fire that resulted from an impact-related breach in the fuel tanks. Information supporting this recommendation is discussed below.

On November 25, 2012, a Robinson R44 II helicopter, N4204A, collided with a structure at Corona Municipal Airport, Corona, California. The pilot/owner, who was operating the helicopter under the provisions of 14 *Code of Federal Regulations* (CFR) Part 91, died as a result of his injuries. The helicopter was substantially damaged from impact forces and a postcrash fire.[1] Although this accident is still under investigation, preliminary evidence indicates that the accident was survivable and that the pilot succumbed to injuries related to the postcrash fire.[2]

The NTSB has investigated, since 2008, three other R44 helicopter accidents in which the fuel tanks were breached, resulting in leaking fuel and a postcrash fire.[3] In addition, since 2011, three similarly equipped R44 helicopters were involved in accidents in Australia.[4] Analysis of data from the US and Australian accidents showed that they should all have been survivable with minor or no injuries to the occupants.[5] However, the accidents in the United States, including the Corona accident, resulted in two fatalities and two serious thermal injuries, and the accidents in

[1] Additional information about this accident, WPR13IA054, can be found at the NTSB's website, which can be accessed at http://www.ntsb.gov.

[2] For more information, see DFW08LA122, WPR10LA478, and CEN12CA443 at the NTSB's website, which can be accessed at http://www.ntsb.gov.

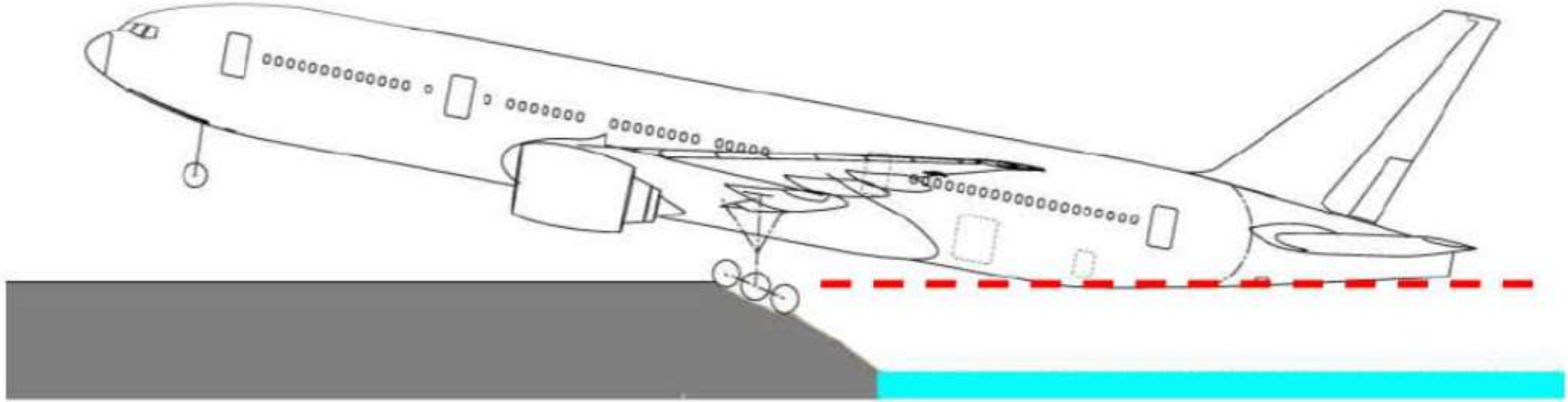
[3] For more information, see AO-2011-018, AO-2011-031, and AO-2013-031 at the ATSB's website, which can be accessed at http://www.atsb.gov.au.

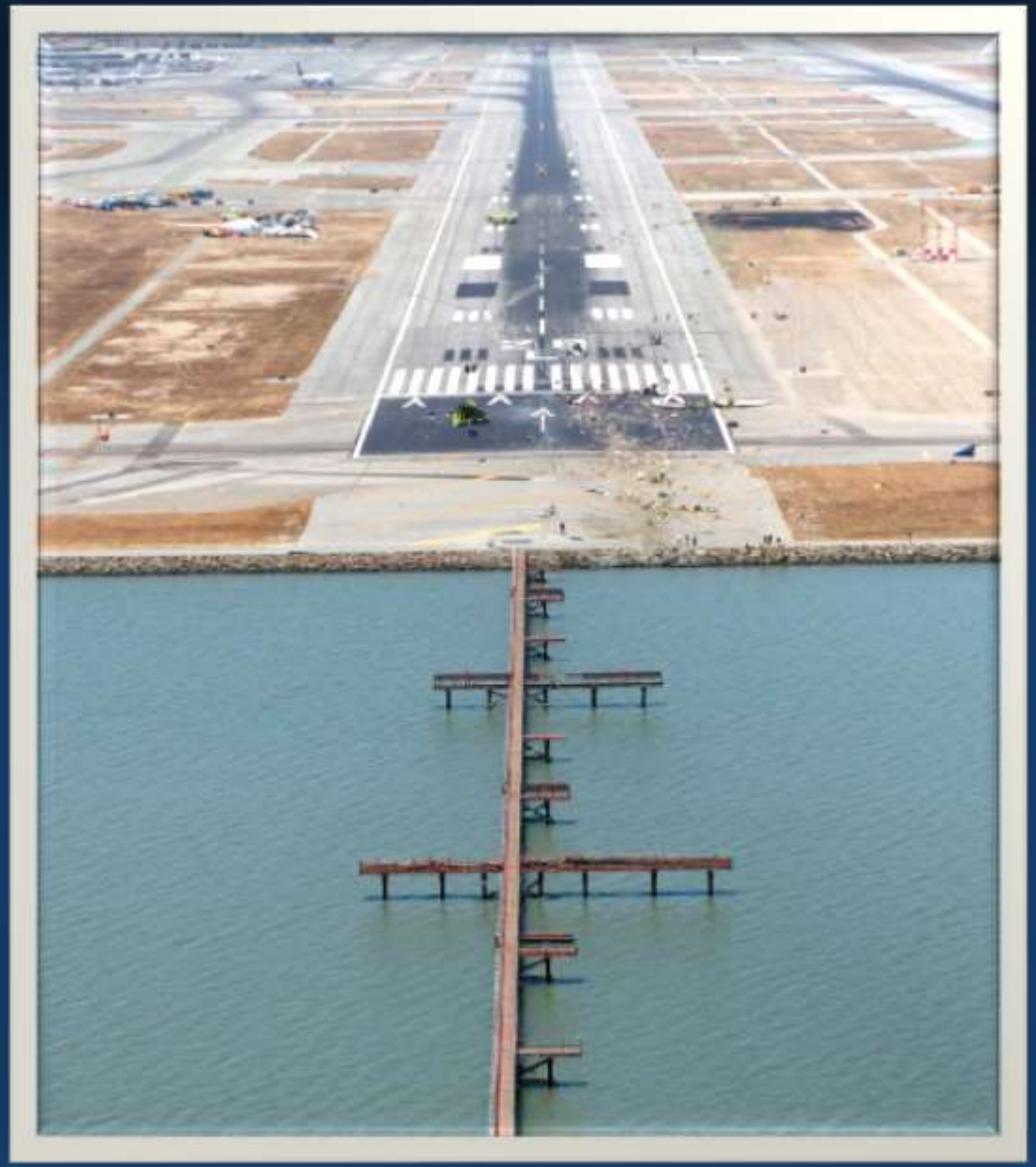
[4] Two of the occupants involved in these accidents survived with minor or no injuries. For DFW08LA122, the pilot received minor injuries (but the passenger received fatal injuries). For CEN12CA443, the pilot (the only occupant) was not injured.

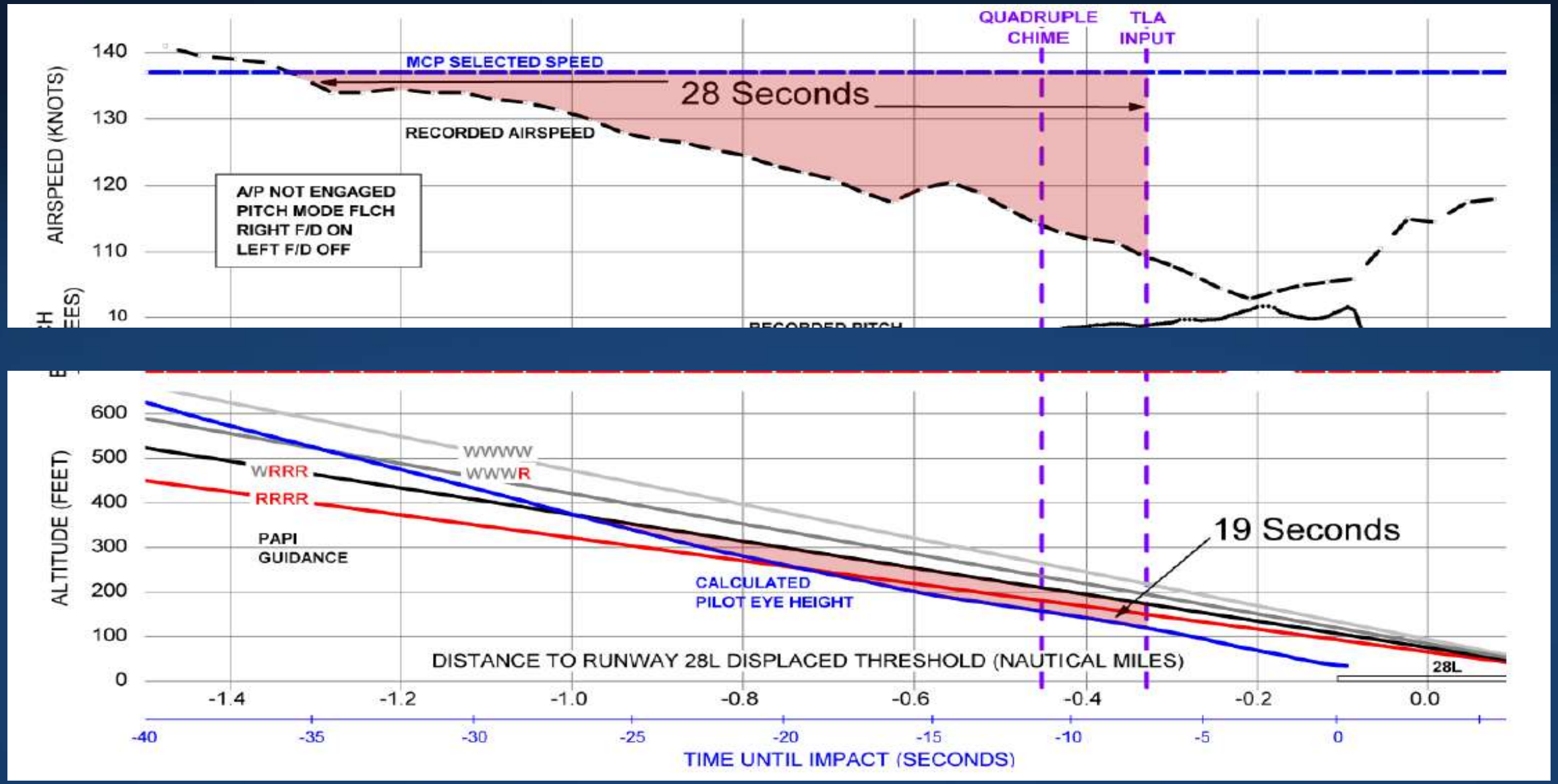
Asiana flight 214

- July 6, 2013
- San Francisco, California
- 3 Fatalities

Estimated aircraft position at impact with seawall






QUADRUPLE CHIME
TLA INPUT
MCP SELECTED SPEED
28 Seconds
RECORDED AIRSPEED
A/P NOT ENGAGED
PITCH MODE FLCH
RIGHT F/D ON
LEFT F/D OFF
AIRSPEED (KNOTS)
140
130
120
110
10
WWWW
WWWR
WRRR
RRRR
PAPI
GUIDANCE
CALCULATED
PILOT EYE HEIGHT
19 Seconds
ALTITUDE (FEET)
600
500
400
300
200
100
0
DISTANCE TO RUNWAY 28L DISPLACED THRESHOLD (NAUTICAL MILES)
-1.4
-1.2
-1.0
-0.8
-0.6
-0.4
-0.2
0.0
28L
-40
-35
-30
-25
-20
-15
-10
-5
0
TIME UNTIL IMPACT (SECONDS)

Automation Reliance

- “The [pilots] believed the A/T system was controlling speed with thrust, they had a high degree of trust in the automated system, and they did not closely monitor these parameters during a period of elevated workload.”
- “Thus, the flight crew’s inadequate monitoring of airspeed and thrust indications appears to fit this pattern involving automation reliance.”
- “The NTSB concludes that insufficient flight crew monitoring of airspeed indications during the approach likely resulted from expectancy, increased workload, fatigue, and automation reliance.”

27 Recommendations

- FAA (15)
- Asiana Airlines (4)
- Boeing (2)
- ARFF Working Group (4)
- City of San Francisco (2)

Two critical elements of accident investigations

Independence

- the investigation is independent of outside influences

Transparency

- allowing the public to see inside the investigative processes so a reasonable person can draw the same conclusions as you did

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CBS :25:40 SEP 9 69
IOWA
MICH.
OHIO
INDIANA
ILLINOIS
KENTUCKY

Independence

"The most important single aspect of the National Transportation Safety Board must be its total independence from those governmental agencies it oversees in regard to their transportation regulatory functions. If the Board is under pressure from any administration to pull its punches or to tone down it's reports or to gloss over Government errors in transportation safety, then its watchdog function has been fatally compromised."

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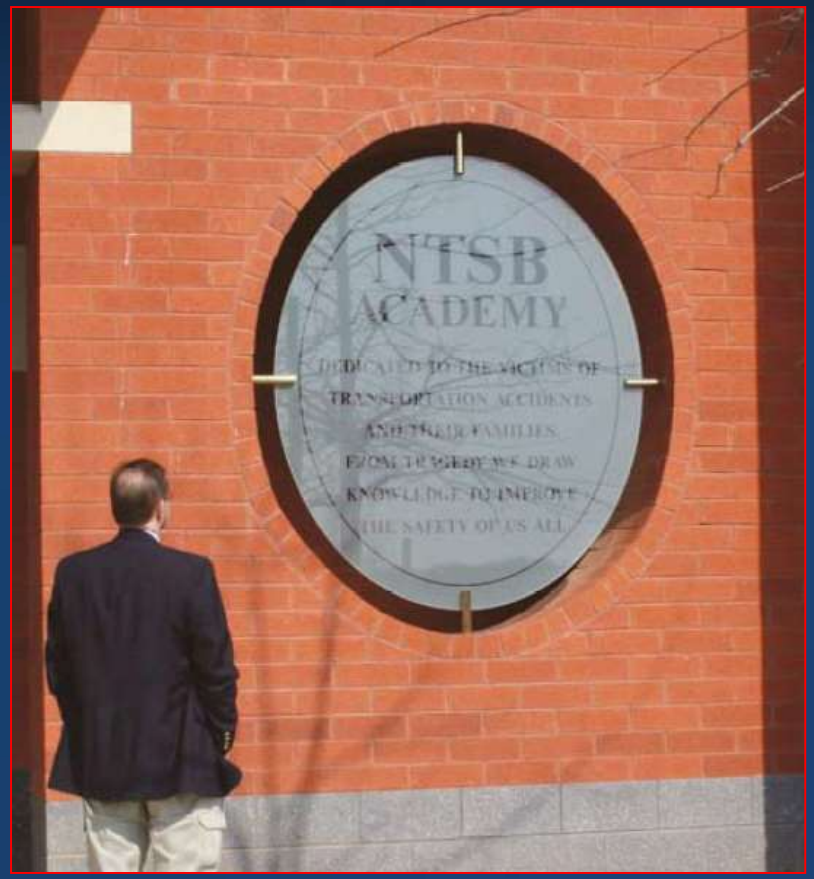
Transparency

portation Safer
DAY ★ TOMORROW


NTSB
NTSB
Fox News


Validation for Safety
Validation for Safety



"From tragedy we draw knowledge to improve the safety of us all."


MAKING TRANSPORTATION SAFER
NATIONAL TRANSPORTATION SAFETY BOARD
E PLURIBUS UNUM
1967
2017
YESTERDAY ★ TODAY ★ TOMORROW